# Ball-and-Socket Joint

The invention relates to a ball-and-socket joint, intended particularly for motor vehicles, having a joint pin provided with a joint ball, a plastic joint housing into which is inserted a bearing shell for the rotatable, and to a limited extent tiltable, support of the joint ball, and a metal ring to positively lock the bearing shell within the joint housing.

Such ball-and-socket joints are known, for example, from DE 195 42 071 A1. The preferably plastic bearing shell inserted into the joint housing is fixed within the joint housing by a snap connection.

The object of the invention is to further develop a ball-and-socket joint of the initially described type to make it suitable, without an appreciable increase in costs, for increased static and dynamic loads in the direction of the joint axis and for use as a radial or axial joint.

This object is attained by the invention in that the metal ring is embedded within the joint housing and has a radially inwardly bent end segment located in the area of the opening in the joint housing provided for the passage of the joint pin.

This "injected" metal ring, which is embedded in the joint housing during its production, i.e., by extrusion coating during the production of the joint housing, is used on the one hand to positively lock the bearing shell within the joint housing by reshaping its end segment such that the ball-and-socket joint can support higher axial joint pin loads. On the other hand the metal ring reinforces the plastic joint housing such that a radial expansion of said joint housing upon axial loading of the joint pin is prevented, which further increases the axial loading capacity of the ball-and-socket joint according to the invention. Since the metal ring can be readily integrated in the joint housing by extrusion coating during the production of the joint housing, the aforementioned advantages compared to

conventional ball-and-socket joints can be achieved without appreciable cost increases.

According to a further feature of the invention, the metal ring, on its end that is extrusion coated with the material of the joint housing, is provided with a radially outwardly angled flange to fix the metal ring securely within the joint housing. In a preferred embodiment of the invention, the flange protrudes at an approximately 90° angle from a cylindrical center part of the metal ring.

In a preferred embodiment of the invention, the inside diameter of the cylindrical center part of the metal ring approximately corresponds to the outside diameter of the bearing shell, so that the cylindrical center part of the metal ring simultaneously serves as a precise guide for the bearing shell.

To enhance the strength of the plastic joint housing, the cylindrical central part of the metal ring ends approximately in the area of the ball equator of the joint housing such that the metal ring strengthens the housing along its critical part against radial expansion.

To permit problem-free expansion of the bearing shell as the joint ball is inserted, the invention furthermore proposes to provide the bearing shell along its pin-side area with slits extending up into the area of the ball equator. A further feature of the invention proposes to provide the bearing shell along its head-side area facing away from the joint pin with indentations extending parallel to the joint axis to create flexible areas for play-free support of the joint ball. In a preferred embodiment the slits and indentations can be formed mutually offset in circumferential direction in the bearing shell.

In a preferred further development of the ball-and-socket joint according to the invention, the joint housing, in the area of its opening, is provided with a ring groove to fix the ball-side end of a sealing bellows.

Finally, the invention proposes to make the joint housing together with a chassis strut from plastic by injection molding as a single piece. This results in a particularly cost-effective production of such a component.

The drawing depicts an exemplary embodiment of a ball-and-socket joint according to the invention, in which:

Fig. 1 is a longitudinal section through a ball-and-socket joint during assembly and

Fig. 2 is a longitudinal section corresponding to Fig. 1 through a finally assembled ball-and-socket joint.

The ball-and-socket joint intended particularly for motor vehicles and shown by way of example comprises a joint pin 1 provided with a joint ball 1.1 as well as a joint housing 2 in which joint pin 1 via its joint ball 1.1 is rotatably and to a limit extent tiltably supported by means of a bearing shell 3. Joint housing 2 and bearing shell 3 are each made of a suitable plastic.

When joint housing 2 is produced by injection molding, a metal ring 4 an exemplary embodiment of which is shown in Fig. 1 and 2 is injected. In the examples shown, metal ring 4 comprises a cylindrical center part 4.1 extending from the opening of joint housing 2 up into the area of equator Ä of joint ball 1.1 which is in its zero position. At this end located within the area of equator Ä, a radially outwardly angled flange 4.2 is formed onto the cylindrical center part 4.1 of metal ring 4, which in the embodiment shown extends at an approximately 90° angle to the cylindrical center part 4.1. Since this flange 4.2 is enclosed by the plastic material of joint housing 2, metal ring 4 is securely anchored within joint housing 2.

With its other initially cylindrical end, metal ring 4 according to Fig. 1 protrudes from the opening of joint housing 2 provided for the passage of joint pin 1.

In the exemplary embodiment depicted in the drawing, the inside diameter of the cylindrical center part 4.1 of metal ring 4 corresponds to the outside diameter of bearing shell 3 such that metal ring 4 forms a guide for bearing shell 3.

After bearing shell 3 mounted on joint ball 1.1 has been inserted in joint housing 2, the end segment 4.3 of metal ring 4 is bent radially inwardly as shown in Fig. 2 from its initial position depicted in Fig. 1 such that metal ring 4 via its end segment 4.3 secures the position of bearing shell 3 within joint housing 2. This positively locked position of the bearing shell within joint housing 2 increases the static and dynamic loading capacity of the ball-and-socket joint in pullout direction of joint pin 1. This loading capacity of the ball-and-socket joint is further increased in that metal ring 4 injected into joint housing 2 secures joint housing 2 against expansion along the portion located between ball equator Ä and the opening.

In the example depicted in the drawing, bearing shell 3 along its pin-side area is provided with slits 3.1 extending up into the area of ball equator Ä. When bearing shell 3 is mounted on joint ball 1.1, these slits 3.1 permit an expansion of the ball-race type bearing surfaces formed by the portion of bearing shell 3 that extends between equator Ä and the opening for the joint pin.

To create flexible areas for play-free support of joint ball 1.1 in the head area of bearing shell 3, bearing shell 3 in its head-side area facing away from joint pin 1 is provided with indentations 3.2 extending parallel to joint axis L. In the depicted example, slits 3.1 and indentations 3.2 are formed mutually offset in circumferential direction in bearing shell 3.

To prevent moisture and dirt from getting into the interior of the ball-and-socket joint, a sealing bellows 5 is used, the pin-side opening of which is fixed in a ring groove of the joint pin 1 by means of a retaining ring 5.1. The ball-side opening of sealing bellows 5 is fixed by means of a retaining ring 5.2 at the end of joint

housing 2 surrounding the opening. For this purpose joint housing 2 is provided with a ring groove 2.1 as shown in Fig. 1.

List of Reference Symbols

| | |
|---|---|
| 1 | joint pin |
| 1.1 | joint ball |
| 2 | joint housing |
| 2.1 | ring groove |
| 3 | bearing shell |
| 3.1 | slit |
| 3.2 | indentation |
| 4 | metal ring |
| 4.1 | center part |
| 4.2 | flange |
| 4.3 | end segment |
| 5 | sealing bellows |
| 5.1 | retaining ring |
| 5.2 | retaining ring |
| | |
| Ä | ball equator |
| L | longitudinal axis |